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SCIENCE

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SPENCER FULLERTON BAIRD—A PIONEER DISSEMINATOR OF SCIENCE NEWS

THE nineteenth century stands out prominently in the history of the world as the one in which the greatest development of science occurred. In the United States a series of great dominant figures has always conspicuously exerted a potent influence for the benefit of humanity on the progress of science.

Even when the century was at its very beginning the splendid figure of the many-sided Franklin was already almost at its zenith. He knew this and he knew that; he talked with this friend and discussed with that friend, and from the gathering of his friends grew the American Philosophical Society, and Philadelphia became the scientific center of the new world.

The scientific mantle of Franklin passed to Robert Hare, a man of wonderful attainments, conspicuously in chemistry, and to him came Benjamin Silliman, who, having absorbed all that he could acquire in Philadelphia, supplemented it with study abroad and then settled in New Haven as professor at Yale College.

Dana and Hubbard, his sons-in-law, Loomis, Olmsted, Shepard and others were his followers and the *American Journal of Science* came into existence as the great event in American science of the second epoch of the century.

Like a meteor in his brilliancy, Samuel Latham Mitchill flashed on the scene in New York, and for a time Columbia College with its splendid and distinguished teachers of science was foremost. Bruce, Hosack and Renwick are familiar names of that period.

When the century reached its high tide, Louis Agassiz with his wonderful personality settled in Cambridge, and Harvard became the Mecca to where, besides his own son Alexander, Hyatt, Lyman, Morse, Putnam, Scudder, Shaler and Verrill came and studied and then spread their knowledge abroad, illuminating wisdom with marvelous skill and adding much to what was known in natural history. The founding of the Museum of Comparative Zoology with its many fortunate students is a noteworthy event of this time.

Almost simultaneously with the progress made in natural science in Cambridge was that made in Washington under Baird, who, as assistant secretary of the Smithsonian Institution, was slowly developing the

National Museum, in which are deposited "all objects of natural history, plants and geological and mineralogical specimens belonging to the United States." Baird was quick to appreciate the wonderful opportunities that were his, for he had the foresightedness to realize that great agencies as those of the Geological Survey and the Bureaus devoted to American ethnology, entomology and fisheries were also great collecting agencies. From them would come the objects that he needed for the National Museum, and so much of his time was devoted to building up these many scientific offices of the government and in training men for their management.

Baird, like Franklin, was a many-sided man, and there have never been wanting those who would tell of the mighty things he did in developing American science; but my task is simply to describe him as the founder of our American News Science Service. "Baird," writes Billings, "for the most part taught only by the pen and by example." Newberry adds that he had correspondents everywhere who were working along his lines in the interest of science.

While others required rest from their arduous labors or sought recreation in amusements or society, Baird found it in intellectual pursuits. The enormous volume of publications that came to the Smithsonian Institution during his long connection with it passed under his inspection, and from this source he gleaned the scientific news of the world.

Miss Lucy Baird, in her charming "Notes" on her distinguished father's career, which are incorporated in William H. Dall's excellent biography of Spencer Fullerton Baird, tells of the origin of his work for periodicals, which is so interesting that I give it in full. She says:

> In 1869, being in the neighborhood of Philadelphia, he went down to Long Branch on a visit to his sisters, who had a cottage there. On the train he found Mr. George W. Childs, who was also on his way to Long Branch. After some little conversation, Mr. Childs asked him to contribute a scientific column, or, to speak more exactly, about half a column, each week to the Philadelphia *Ledger*, giving items of scientific interest. My father, who was modest as to his literary abilities, as in everything else, felt so sure of his inability to write popular paragraphs agreeably that he was inclined at first to decline this offer, although, to a man of limited means, the remuneration proposed by Mr. Childs was a temptation. Mr. Childs, however, begged him to consider the matter and those of his scientific friends, to whom he confided the matter, urged him so strongly that he decided to attempt it.

This seems to have been the beginning of his contributions to current publications, and it soon led to other similar work in which he was most successful.

I shall not attempt in this place to present any record of Baird's other literary productions or express my opinion in regard to his ability as a writer or as an editor. That part of the task has already been most admirably done by G. Brown Goode in Bulletin 20 of the United States National Museum, which forms one of the series of bibliographies of American naturalists and bears the specific title of "Published writings of Spencer Fullerton Baird, 1843–1882."

From that authoritative source, I find that as early as 1871 Baird began to contribute to *Harper's Weekly* and to *Harper's New Monthly Magazine* regularly items on science, concerning which Goode wrote:

> Many of these are original contributions to knowledge never elsewhere published. Others are critical reviews or notes upon the current literature of science. Others are abstracts of papers, with the addition of explanatory or illustrative remarks. Others still are abstracts of papers, for the most part in the words of the authors of the papers or of some other reviewer.

Miss Baird also writes in her "Notes":

> In addition to the work mentioned above (*i.e.*, in connection with publication of the Harpers) he finally entered into a similar arrangement with the New York *Tribune*, to which he furnished a scientific column.

These various abstracts were subsequently collected, more or less revised and then issued annually in book form as "An Annual Record of Science and Industry."[1]

The first of these was published in 1872 and bears on the title page the statement that it was prepared "with the assistance of eminent men of Science." In this volume are no less than 92 items for which Goode gives credit to Baird as being essentially from his pen.

For six years these volumes continued without change and as showing Baird's remarkable industry, when it is remembered that his duties elsewhere were also very arduous, attention is called to the fact that the volume for 1872, according to Goode, contained 193 items written by him, that for 1873, 187 items, that for 1874, 132 items, that for 1875, 106 items and that for 1876, 76 items.

The heavy demand on the time of Baird, due to the declining strength of Henry, followed by his death, and Baird's succession to the secretaryship of the Smithsonian made it more and more impossible to devote as much of his own time as formerly to the preparation of this press information. Accordingly,

[1] I am not unmindful of the fact that from 1849 to 1866 David A. Wells edited an "Annual of Scientific Discovery," but I have never understood that this was more than a year book, for which special articles were prepared at the end of each year summarizing the development of the topics treated during the given period.

there was a change in the methods used in the volumes of the "Record of Science and Industry" for the years 1877 and 1878, which in Baird's own words was as follows:

> A modification of the original plan of the "Annual Record" was commenced in the volume for 1877. Previous to that it consisted of two parts—first, a general summary of progress in the various branches of science; and, secondly, a series of abstracts of special papers, credited to the work in which they were published. These abstracts, although prepared by several specialists, were without indication of their authorship. The experience of several years showed that, in attempting to give abstracts of anything like the most important announcements of the year, more space was required than could be spared for the purpose; and it was therefore determined to enlarge the scope of the first division, and make it include a great amount of detail, each summary to be prepared by some eminent specialist, and to be headed by his name.

This plan was continued with the volume for 1878, the preface of which is dated March 1, 1879, but with this volume the series came to an end. These most admirable summaries were continued in the annual reports of the Smithsonian Institution and formed the most important feature of each of these valuable reports until the death of Baird.

Goode's work as a rule was superior and he seldom omitted an essential item in anything that he wrote, but I am sure that were he living, he would gladly permit me to add the word "editor" to the following description that he wrote of Baird:

> He was one of those rare men, perhaps more frequently met with in the new world than elsewhere, who give the impression of being able to succeed in whatever they undertake. Although he chose to be a naturalist, and of necessity became an administrator, no one who knew him could doubt that he would have been equally eminent as a lawyer, physician, mechanic, historian, business man, soldier or statesman [and editor].

When the publication of the "Annual Record of Science and Industry" ceased with the volume of 1878, it seemed as if the sun had set, but not altogether, for here and there were bright spots in the sky. The *Scientific American*, founded in 1849, was devoted to the exposition of popular science. In 1876 it added its *Supplement* to give to the world a record of the progress in applied knowledge as manifested by the Centennial Exhibition held in that year in Philadelphia. It still lives in a more dignified dress as a well-edited and useful monthly.

Just above the horizon was the *Popular Science Monthly*, then edited by the gifted Edward L. Youmans and devoted to a higher grade of popular science than any of its predecessors. Later came SCIENCE, which has become probably the most important scientific journal ever published in the United States. All these have paved the way for a *Science News Service*, which, ably controlled by E. E. Slosson, again gives to the public statements of the progress and development of science that are as true, honest and reliable as those put forth by Spencer F. Baird.

MARCUS BENJAMIN

SOME PHYSICAL ASPECTS OF A RECENT ANALYSIS OF THE EARTH'S MAGNETIC FIELD[1]

THE difficulties to be met in the formation of any adequate theory of the origin of the earth's magnetism are in part mathematical, in part geometrical, because of the sphericity of the earth-magnet, but they arise chiefly from the physical conditions involved. No matter what theory is proposed somewhere a hypothesis must be introduced implying new properties of matter or physical conditions below and above the earth's surface, regarding which we have at present either no knowledge whatsoever or but the faintest glimpse. The same remarks apply to that other great problem of cosmical physics—the origin of the earth's electricity. It has accordingly been suggested that terrestrial magnetism and atmospheric electricity may reveal to us hitherto unknown properties of matter; for the properties which the rotating earth and the rotating sun may possess, because of their masses, sizes and angular velocities, may fail of detection with the experimental conditions possible in the laboratory.

The most complete and exhaustive analysis heretofore made of the earth's magnetic field, as based on the accumulated magnetic data of the Carnegie Institution of Washington and cooperating organizations, has just reached the preliminary stages of completion. We have now facts of sufficient reliability so that in a number of cases it is possible to say definitely that a theory advanced is not correct or at least not complete.

One of the definite disclosures of interest is that about 94 per cent. of the earth's magnetic field arises from systems of magnetic and electric forces inside the earth; about 3 per cent., except for possible relativity effects, is apparently to be referred to an electric system in our atmosphere, and the balance, about 3 per cent., to a system equivalent in its effects to electric currents passing perpendicularly through the earth's surface. Furthermore, we now know that the direction of the axis of the magnetic field of the earth, of the atmosphere and of the sun is related in the same way, for all three bodies, to the direction of

[1] Presented at the meeting of the American Philosophical Society, Philadelphia, April 21, 1923.

rotation of the body, and that the magnetic axis for each of the three bodies is inclined to the axis of rotation, namely, at present, 11.5° for the earth, about 14° for the atmosphere, and about 6° for the sun. The strength of the magnetic fields of these three bodies may be expressed approximately by the product of a physical factor, f, into the angular rotation, ω, the square of the radius, r, and the density, D, of the body. If the same formula could be applied to the other planets, Jupiter, for example, would be enveloped by a magnetic field about as strong as that around the sun.

The physical factor, f, may imply new physical properties or changes in the usual laws of electrodynamics, which may possibly be found to hold throughout our universe. But we find that the earth's intensity of magnetization has been diminishing during the past 80 years at the average rate per annum of 1/1,500 part; how much longer this startling rate of diminution will continue we, of course, can not say at present. The more interesting question is, What changes inside or outside the earth can produce such remarkable changes? Certainly the period of rotation, dimensions and density of the earth have not changed sufficiently during the past 80 years to account for the magnetic change. Shall we say our universal physical factor, f, has changed sufficiently in 80 years to be responsible for the corresponding magnetic change? If so, what does that mean? Are the new physical properties, or the changes in well-known physical laws, implied in f, subject to rather rapid changes, and if so, why?

Let us suppose, for example, that in the factor f we have embodied some physical relation upon which both the earth's magnetism and its gravitational force depend. Then, on the basis of the average annual loss in the earth's magnetism, during the past 80 years, 1/1,500 part, we can immediately say that magnetism and gravity are not related to each other as the first power of the factor. For otherwise a change of 1/1,500 part in the earth's magnetism would imply a corresponding change of 1/1,500 part in gravity, a change too large to have escaped detection. On the other hand, magnetism and gravity may be so related that a magnetic change of 1/1,500 part would only imply a change of the square of 1/1,500 part, or about one half of a millionth part in gravity, and this is a quantity which may readily escape detection with our present gravity appliances unless observations with requisite accuracy are made continuously for a number of years at certain standard stations, so as to obtain the accumulative effect.

The examples cited may suffice to show what importance investigations relating to the earth's magnetism and electricity may assume in our studies of the properties of matter.

A theory which is at present receiving careful examination starts with the possibility that there may be motion of electricity, for example, relative to the mass or volume elements. The rate of motion may differ by a very small fraction from that of the angular rotation of the earth and the paths of the comparatively slowly moving electric particles may be subject to a deflecting effect during the earth's rotation, just as are winds blowing over its surface. The net result of the earth's deflecting effect on these "currents" may be such as to cause, on the average, a slow westerly movement of this system of currents, which in turn gives rise to an induced or demagnetizing field, superposed on the primary field. If such currents are the cause of the earth's internal magnetic field, then their distribution at any given time appears to be largely dependent upon the distribution of land and water, doubtless chiefly because of the difference in electric conductivity of the two bodies. While the results of such a theory would in general agree with the observed facts, it will have to be subjected to further careful investigation before any definite statement may safely be made.

As a resultant effect of all systems causing the secular variation of the earth's magnetism, the north end of the magnetic axis of the internal system of the earth's magnetic field, during the past 80 years, has been moving slowly towards the west, and apparently at the same time slowly towards the equator. The indications are that if the magnetic axis completely revolves around the axis of rotation, the period would not be a few hundred years, but many thousand years. The secular variation thus results from changes, with lapse of time, both in the direction of magnetization and in the intensity of magnetization.

A suggestive effect, dependent apparently upon the distribution of land and water, has been disclosed, namely, that the average equivalent intensity of magnetization, for corresponding parallels north and south, is generally larger for the land-predominating parallel than for the ocean-predominating parallel.

For the earth's internal uniform magnetic field, the following data apply for 1922: The magnetic moment, M, is 8.04×10^{25} C. G. S.;[2] the components of M, respectively parallel and perpendicular to the earth's axis of rotation, are $M_p = 7.88 \times 10^{25}$ C. G. S., and $M_e = 1.60 \times 10^{25}$ C. G. S.; $M_p = 4.93\ M_e$. Were the earth's magnetism uniformly distributed throughout the earth, as it probably is not, the average intensity of magnetization would be 0.074 C. G. S. The magnetic axis intersects the North Hemisphere in

[2] The value of the magnetic moment frequently found in text-books, as dependent on Gauss's analysis for 1830, is 8.55×10^{25} C. G. S. The average annual rate of loss between 1830 and 1922 is about 1/1,500 part, thus corresponding with the annual average rate as given above.

latitude 78° 32′ north and longitude 69° 08′ west of Greenwich.

For fuller details the interested reader may be referred to the issues of *Terrestrial Magnetism and Atmospheric Electricity* for March–June and September, 1923.

LOUIS A. BAUER
DEPARTMENT OF TERRESTRIAL MAGNETISM,
CARNEGIE INSTITUTION OF WASHINGTON

ALICE C. FLETCHER

IN the year 1881 there appeared on the Omaha reservation, in Nebraska, a white woman. She visited the Indians in their homes and began to make friends with them. At first they were not disposed to talk, but after a time it occurred to one to ask: "Why are you here?" She replied: "I came to learn, if you will let me, something about your tribal organization, social customs, tribal rites, traditions and songs. Also to see if I can help you in any way."

At the suggestion of help the faces of the Indians brightened with hope. The Indian continued: "You have come at a time when we are in distress. We have learned that the 'land paper' given us by the Great Father does not make us secure in our homes; that we could be ousted and driven to the Indian Territory as the Poncas were. We want a 'strong paper.' We are told that we can get one through an act of Congress. Can you help us?"

The little woman replied: "Bring me your 'land paper' and come prepared to tell me about your home and the size of the land you have in cultivation. Come soon." The news spread and the Indians came. Each one uttered the oft repeated cry: "I want a 'strong paper' which will make my home secure, so I can work without fear of being ousted." For days the little friend worked hard writing each man's story of his struggle to live by cultivating the soil. This part of the work being done, she then took up the hardest task, that of framing a petition to be signed by the Indians and sent to Congress, which was something new in her experience.

Here was a woman with a courageous heart, full of true sympathy for humankind, sympathy which found expression, not in well phrased words, but in well planned action. This brave, unselfish woman was Alice C. Fletcher, whom the Omahas learned to love.

The petition was signed and on December 31, 1881, sent to Senator Morgan of Alabama. On January 12, 1882, he wrote that on the 11th he presented the petition and it was recorded. Later a bill was introduced in the Senate for allotting lands to the Omahas and for the issuance of trust patents to them. Miss Fletcher came to Washington to help push the bill through. It passed both houses, was approved August 7, 1882, and became law.

In April, 1883, Miss Fletcher was appointed special agent to carry out the provisions of the law. When she was about to begin her work the older members of the tribe came together for consultation as to how they could best express their gratitude for what she had done for the tribe. They decided to perform for her the ancient calumet ceremony, although it was not customary to give it informally. A notice was given to the people to come, and on the day appointed many came and assembled in an earth lodge. The calumets were set up in their sacred place, and when Miss Fletcher entered as the honored guest the house became silent. Three men arose and took up the symbolic pipes (the calumets) and the lynx skin on which they rested; then, standing side by side, they sang softly the opening song. At the close the three men turned, and facing the people, who sat in a wide circle, sang a joyful song as they moved around the circle, waving the sacred pipes over their heads. Song after song they sang for their friend, of the joy and happiness that would follow when men learned to live together in peace. When the evening was over they told Miss Fletcher that she was free to study this or any other of their tribal rites.

Miss Fletcher carried on her ethnological researches among the Omaha, Pawnee, Winnebago, Sioux, Nez Perce and other tribes. She published many papers descriptive of the life and ceremonials of the tribes she studied. The most important of these papers are: "The Omaha Tribe," which was published in the Twenty-seventh Annual Report of the Bureau of American Ethnology; "The Hako: A Pawnee Ceremony," which accompanies the Twenty-second Annual Report of the Bureau; and "Indian Story and Song from North America," published by Small Maynard & Company, in 1900. Many of the ceremonial songs collected by Miss Fletcher have been used as themes by American composers, notably by Cadman, Farwell and others. She held the Thaw Fellowship, Peabody Museum, Harvard University, from 1891 to the time of her death, but had been an assistant in the same institution at a still earlier period. She was vice-president of Section H, A. A. A. S., in 1896; president of the Anthropological Society of Washington in 1903; and president of the American Folk-Lore Society in 1905.

This great friend of the Indians was born in Cuba on the 15th day of March, 1838; on the evening of April 6, 1923, she passed away in her home, in Washington, D. C.

FRANCIS LAFLESCHE

SCIENTIFIC EVENTS

RAMSAY MEMORIAL FELLOWSHIPS

THE Ramsay Memorial Fellowship Trustees announce the following elections to fellowships and renewals of fellowships for the session 1923–24:

A British fellowship of £300 to Mr. Samuel Coffey, M.Sc., London, Ph.D., Leiden, to carry out research at University College, London.

A British fellowship of £300 to Mr. Alan Francis Titley, B.Sc., Bristol, D.Phil., Oxford.

A British fellowship of £300 renewed to Dr. R. W. Lunt, B.Sc., M.Sc., Ph.D., Liverpool, at present working at University College, London.

A Glasgow fellowship of £300 to Mr. Thomas S. Stevens, B.Sc., to carry out research work at the University of Glasgow.

A Glasgow fellowship of £300 renewed to Mr. J. A. Mair, to enable him to continue work at the University of Glasgow.

A Norwegian fellowship of 5,400 kroner, to Mr. Gunnar Weidsmann, to work at Cambridge under Professor Gowland Hopkins.

A French fellowship of the value of £100, *plus* 14,000f., to Dr. H. Weiss, of La Sorbonne, who will work under Professor Sir William Bragg at the Royal Institution (Davy Faraday Laboratory).

A Netherlands fellowship of £300 to Mr. J. Kalff, doctorandus in chemistry of Amsterdam.

A Danish fellowship of £300 to Mr. Kristian Hjandahl, who will continue work at the University of Liverpool.

Appointments to the Canadian, Greek, Italian and Swedish fellowships will be announced shortly.

Since the institution of the Ramsay Memorial Fellowship Trust in 1919, fellowships have been held by twenty-one fellows, not including the new fellowships announced above. Apart from the British fellowships, the Canadian fellowships and the special Glasgow fellowships, the Ramsay fellowships have been held by American, Danish, Dutch, Greek, Italian, Japanese, Norwegian, Swedish and Swiss fellows.

Information has recently been obtained as to some of the posts held by former Ramsay fellows since their occupation of Ramsay fellowships. One British fellow, Dr. A. E. Mitchell, has been appointed assistant lecturer in chemistry at University College, London. The Greek fellow, Dr. B. C. Papaconstantinou, worked under the Greek Minister of War in Asia Minor testing the explosives for the Greek Army, and is now lecturer in physical chemistry at the University of Athens. The Swedish fellow, Dr. Lennart Smith, has been appointed professor of chemistry at Lund. The Swiss fellow, Dr. Charles Naegeli, is assistant lecturer in the chemical laboratory in the University of Zurich.

Another Swiss fellow, M. Etienne Roux, has been granted the degree of doctor of philosophy of the University of Oxford and has been appointed research chemist in the French firm "Matières Colorantes et Produits Chimiques de St. Denis" in Paris. The Italian fellow, Dr. Remo de Fazi, has been appointed professor of general and applied chemistry in the R. Scuola Superiore di Architetture di Roma, lecturer in general chemistry in the University of Rome, and assistant in applied chemistry in the R. Scuola di Applicazione per gli Ingegneri di Roma.

THE INTERNATIONAL PHYSIOLOGICAL CONGRESS[1]

THE International Physiological Congress, comprising over four hundred eminent physiologists from all parts of the world, began its sittings in Edinburgh on July 24. Captain Walter E. Elliot, undersecretary for health for Scotland, on behalf of the government, welcomed the members of the congress. It was with some trepidation in these days, he said, that governments approached scientific men, because the happy contempt with which the politician used to regard the scientist had been rudely shaken by the events of the past seven years, and none of them were likely to forget the days of the war, when whole nations were, practically speaking, subjects of gigantic physiological experiments and where the success or failure of some enormous combination might be based on the obscure calculations of some scientist in a laboratory, of whose name rulers of states till then had scarcely been conscious.

Principal Sir Alfred Ewing extended a most hearty and sympathetic welcome on behalf of Edinburgh University. They had had a chair of physiology since 1685 directly, and indirectly the university had made considerable contributions to physiological knowledge, and they did not need to be told of the great work which Sir Edward Schafer, their president, had carried on, and was carrying on, within the walls of the university. His investigations regarding endocrine glands had opened up new vistas in medicine, and perhaps still unexplored vistas in controlled natural health and processes of growth.

Professor Sir Edward Sharpey Schafer, in his presidential address, said he desired to associate the name of Lister with that gathering, because Lister was for several years professor of surgery at Edinburgh, but chiefly on account of the fact that the researches which preceded his great discovery were researches in pure physiology, and were inspired by that great teacher, William Sharpey, who migrated in 1836 from Edinburgh to London, and to whom he himself and many other British physiologists owed, directly or indirectly, their introduction to their science.

A lecture on insulin was delivered by Professor J. J. R. Macleod, of the University of Toronto, who

[1] From the London *Times*.

said that he and his colleagues considered it a very great honor that an account of their researches on insulin should be given so prominent a place on the program. There was no other problem in the whole vast field of medical science that had attracted such diverse groups of workers as that of the relationship between the pancreas and disturbances in carbohydrate metabolism. Professor Macleod sketched the history of the discovery of insulin by Banting and Best, who worked in his laboratories. Insulin appeared to act not in the blood but in the tissue cells themselves. It caused the tissue cells to take up more glucose (blood sugar). "Insulin sets up some process by which, as it were, a vacuum for sugar becomes established in these cells, so that sugar is removed from the blood."

The various theories which have been advanced to explain this removal were discussed, and then Professor Macleod pointed out that insulin, or at least substances resembling it in certain particulars, had been obtained from clams and other shellfish and, in the case of yeast, from the vegetable kingdom.

SYMPOSIUM ON INDUSTRIAL, AGRICULTURAL AND FOOD CHEMISTRY

"BREAD" will be the subject for the symposium which will occupy the first half-day of the Industrial Division's session at the Milwaukee meeting of the American Chemical Society during the week of September 10. Under this heading will be presented papers dealing with the following:

1. Flour—Its manufacture.
2. Flour—Its physico-chemical characteristics.
3. Bread materials—How they are purchased, how formulas are set and carried out in production.
4. Control processes—How the baker regulates temperature, flour storage, fermentation rooms, mixer, oven, proof box, cooling rooms; humidity, in fermentation rooms, proof box and oven, synthesized operations, etc.
5. Bread—Its rôle in nutrition. A discussion of the new developments which our growing knewledge of vitamins and nutrition is stimulating.
6. Possibly some discussion of world wheat production, having in mind the probability that within a few decades our increasing population and diminishing wheat acreage will present a most vital problem.

Some of the speakers before this symposium will be: Professor Bailey, University of Minnesota; Professor R. A. Gortner, State Experiment Station of Minnesota; Dr. H. E. Barnard, director, American Institute of Baking; Dr. G. C. Thomas, Atlas Bread Factory, Milwaukee; Professor Worth Hale, Harvard Medical College. Dr. H. E. Barnard, director of the American Institute of Baking, will preside.

The afternoon of the first day's session will be devoted to a joint meeting with the Chemical Education Section under the leadership of Dr. Edgar F. Smith, on "Chemical Education."

THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE annual meeting of the association was held at Bordeaux from July 30 to August 4 under the presidency of M. Desgry, a member of the Academy of Medicine. A list of the sections with their presidents follows: Mathematics, astronomy, geodesy and mechanics, Lieutenant Colonel Perrier; Navigation, aeronautics, civil and military engineering, M. Charles Camichel; Physics, M. Maurice de Broglie; Chemistry, M. Georges Denigès; Meteorology and physics of the globe, M. Luc Picart; Geology and mineralogy, M. Joseph Blayac; Botany, M. Lucien Beille; Zoology, anatomy and physiology, M. Louis Boutan; Anthropology, Dr. Henri Martin; Medical sciences, M. Jules Sabrazès; Medical radiology, Dr. Louis Jaulin; Odontology, M. Louis Quintin; The pharmaceutical sciences, M. Albert Astruc; Experimental psychology, Dr. Angelo Hesnard; Agriculture, M. Ulysse Gayon; Geography, M. E. Camena d'Almeida; Political economy and statistics, M. G. Pirou; Education, M. Julien Ray; Hygiene and public health, M. B. Auché; Sub-section for archeology, M. J. A. Brutauks; for linguistics and quantitative philology, M. J. Depoin.

THE LOS ANGELES MEETING

ARRANGEMENTS for the seventy-seventh meeting of the American Association for the Advancement of Science to be held in Los Angeles from September 17 to 20 are appropriately in charge of the Pacific Division of the association which will then be holding its seventh annual meeting. The Pacific Division covers a wide range of territory, including over one thousand members. Its meetings have been held successively at San Diego, Stanford University, Pasadena, Seattle, Berkeley, Salt Lake City, and this year at Los Angeles. The Southwestern Division, embracing a membership in Arizona, New Mexico, western Texas and Chihuahua, Mexico, will this year unite with the Pacific Division and the summer session of the association as a whole, holding its fourth annual meeting in Los Angeles.

The Southwestern Division will be represented on the program of the general sessions by the address of its president, Dr. V. M. Slipher, of Lowell Observatory, who will speak on "The Planets" on Monday evening, September 17, sharing the platform with Dr. E. P. Lewis, president of the Pacific Division.

Secretary E. A. Beals, of the American Meteorological Society, reports great interest among meteorologists and foresters in the Los Angeles meeting, with

many important papers already scheduled. It is likely that their presentation will require several sessions. A whole day session is planned for a symposium to discuss the relationship between weather and forest fires.

The meeting of the American Association of Petroleum Geologists which is arranged for September 20 to 22 will be representative of the oil interests of the United States and Mexico and will be a significant event in the development of this important industry and of this branch of geology. The association has a large membership, including many prominent geologists. Their program will be of great general interest. The holding of these sessions following the period allotted for the general convention will afford an opportunity for attendance of which many will take advantage.

Secretary C. O. Esterly, of the Western Society of Naturalists, anticipates an attendance of at least 200 members. One session on Tuesday afternoon, September 18, will be devoted to a joint symposium with the Ecological Society of America on "Evolutionary and Ecological Aspects of Distribution of Plants and Animals in California." Papers will be presented on plant life of the desert by Dr. Forrest Shreve; on different aspects of evolution among desert animals, by Dr. Joseph Grinnell and by Dr. Francis B. Sumner, and on floral elements of California, by Dr. LeRoy Abrams.

One of the significant features of the Los Angeles program will be a joint symposium arranged for Wednesday afternoon, September 19, in which the Physiological Section of the Botanical Society of America, The American Phytopathological Society of America, the American Association of Economic Entomologists and the Ecological Society of America will participate, the subject being "Ecological Factors in the Distribution and Severity of Plant Diseases and Insect Pests."

W. W. SARGEANT,
Secretary of the Pacific Division

SCIENTIFIC NOTES AND NEWS

RAPHAEL PUMPELLY, the distinguished geologist and explorer, died at his home in Newport, on August 10, at the age of eighty-six years.

DR. T. WINGATE TODD, professor of anatomy in the school of medicine of Western Reserve University, Cleveland, has been elected foreign corresponding member of the Royal Academy of Brussels, Belgium. Dr. Todd's election was unanimous, a result which has not occurred in years.

GEORGE W. CARVER, Tuskegee Institute, has been awarded the Spingarn medal for 1922, given annually for the most notable achievement by an American citizen of African descent. Mr. Carver is known for his work in applied chemistry in agricultural products, particularly those of the peanut and sweet potato.

THE DUKE OF CONNAUGHT, president of the Royal Society of Arts, at a meeting of the society in July presented the Albert Medals of the society, awarded to Sir David Bruce and Sir Ronald Ross "in recognition of the eminent services they have rendered to the economic development of the world by their achievements in biological research and the study of tropical diseases."

DR. PINERUA, professor of chemistry, University of Madrid, will be guest of honor at a banquet given in connection with the unveiling of his bust in his lecture hall by former students on his reaching the age limit.

AT the Portsmouth meeting held during the third week of July, Dr. C. P. Childe was elected president of the British Medical Association.

DR. A. RUSSELL has been elected president and Sir James Devonshire vice-president of the British Institution of Electrical Engineers.

SURGEON REAR-ADMIRAL JOSEPH CHAMBERS has been appointed director-general of the Medical Department of the British Navy, in succession to Surgeon Vice-Admiral Sir Robert Hill, to date from October 1, 1923.

S. T. DANA, forest commissioner of Maine, has been appointed director of the northeastern forest experiment station of the Forest Service, which was provided for by the last Congress, according to an announcement by the United States Department of Agriculture. It will cover in its activities the northeastern forest region, including the New England States and New York, with headquarters at Amherst, Mass.

DR. FRANK M. PHILLIPS, who has been with the U. S. Public Health Service for the past four years, has accepted the position of chief of the Division of Statistics, effective August 1. He has been retained as consultant in research in the Public Health Service and in the Bureau of Mines. He is also professor in statistics at George Washington University.

DR. NATHANIEL ALLISON, dean of the Medical School of Washington University, St. Louis, has been appointed chief of the Orthopedic Department of the Massachusetts General Hospital.

DR. LELAND E. COFER has been appointed director of the division of industrial hygiene of the New York State Department of Labor. Dr. Cofer has been an officer in the U. S. Public Health Service for more than thirty years.

M. JEAN BOSLER has been nominated by the Paris Academy of Sciences for director of the observatory at Marseilles.

PROFESSOR LUBARSCH has been appointed director of the Robert Koch Foundation for Combating Tuberculosis in place of the late Professor Orth.

MAURICE L. HUGGINS, who has held a National Research fellowship in chemistry during the past year at Harvard University, has been reappointed for the coming year, which he will spend at the California Institute of Technology at Pasadena, carrying on researches in the field of crystal analysis by means of X-rays.

DR. F. L. RANSOME, who has been a member of the U. S. Geological Survey since 1897, leaves Washington on September 6 to take up his new work as professor of economic geology and head of the department of geology at the University of Arizona, at Tucson, Arizona. Dr. Ransome has accepted the appointment for the coming academic year, but has not resigned from the Geological Survey and is under no engagement to remain permanently at Tucson.

VICTOR YNGVE, who has been engaged in cryogenic research at Harvard University during the past year, has accepted a position as director of research for the Manhattan Electrical Supply Co., New York City.

A. T. MCPHERSON, Ph.D. (Chicago, '23), has accepted a position as associate chemist in the Bureau of Standards, where he is engaged in the investigation of rubber and gutta percha as insulating materials.

LOWELL H. MILLIGAN, Ph.D. (Cornell '23), has taken a position as research chemist with the Norton Co., at Worcester, Mass.

DR. J. WALTER FEWKES, chief of the bureau of American ethnology of the Smithsonian Institution, has returned to Washington from an investigation of pottery found in the Mimbres Valley in New Mexico.

CHARLES W. COULTER, assistant professor of sociology in Western Reserve University, has returned to the United States after an absence of over a year in China, where he taught at Nanking University, in Nanking; at Nankai University in Tientsin and in Peking University.

PROFESSOR BURTON CAMP, of the department of mathematics of Wesleyan University, has been granted leave of absence for the college year, 1923–1924. Professor Camp is planning to work at the library of the University of Paris and later to work on the mathematical theory of statistics with Professor Karl Pearson at the Biometric Laboratory of University College, London.

DR. WILHELM SEGERBLOM, secretary of the commission to revise the definitions of the requirement in chemistry of the College Entrance Examination Board, writes that the commission desires to have the benefit of all opinion adverse or otherwise on the present syllabus. All teachers who wish to criticize either the chemistry syllabus itself or the examinations set in accordance therewith or who may have constructive comments looking towards improvements in the requirement are requested to send such information to the chairman of the revision commission, Prof. Percy T. Walden, Department of Chemistry, Yale University, New Haven, Connecticut.

THE following awards were made at the meeting of the trustees of the Elizabeth Thompson Science Fund on May 28: Dr. E. B. Krumbhaar, Philadelphia General Hospital, Philadelphia, Pennsylvania, for the study of immunity to cancer, $150. Professor H. A. Laurens, Yale University School of Medicine, New Haven, Conn., toward the purchase of a monochromatic illuminator for the visible and ultra violet, $300. Dr. W. W. Swingle, Osborn Zoological Laboratory, Yale University, New Haven, Conn., to aid in the completion of experiments on endocrine glands, $150. The Elizabeth Thompson Science Fund is administered by G. H. Parker, *president*; E. B. Wilson, *secretary*; Charles S. Rackemann, *treasurer*, and G. P. Baxter and W. B. Cannon, members of the board of trustees. The trustees meet three times a year toward the end of February, of May and of November. Applications should be in the hands of the secretary well in advance of the date of the meeting.

UNIVERSITY AND EDUCATIONAL NOTES

BY the will of Nettie Fowler McCormick, widow of Cyrus H. McCormick, inventor of the reaper, Washington and Tusculum College at Tusculum, Tennessee, received $100,000.

BOSTON UNIVERSITY has received a bequest of $100,000 from the late Austin B. Fletcher, of New York, a member of the board of trustees.

DR. CHARLES A. KRAUS, professor of chemistry in charge of graduate work and director of the research laboratories of chemistry at Clark University, Worcester, will join the faculty of Brown University in September, 1924.

DR. WILLIAM H. GOODRICH, Augusta, has been elected dean of the University of Georgia School of Medicine to succeed the late Dr. William H. Doughty.

ALTON LINCOLN SMITH, professor of drawing and machine design at the Worcester Polytechnic Institute, has been elected to the newly established position of assistant to Dr. Ira N. Hollis, president of the institute. Professor Smith, who is one of the oldest

members of the faculty, will preside at faculty meetings in the absence of the president and otherwise perform his duties.

HARRY S. SMITH, formerly chief of the Bureau of Pest Control of the State Department of Agriculture of California, has been appointed associate professor of entomology in the University of California, to be stationed at Riverside.

THE French Academy of Sciences has nominated M. Henri Piéron to the chair on the physiology of the senses at the Collège de France.

DISCUSSION AND CORRESPONDENCE

HORSE FLESH IN ENGLAND IN THE ELEVENTH CENTURY

A NOTE on the use of horse flesh in Europe, in SCIENCE (N. S. 44 [1916], No. 1140, pp. 638–639), pointed out that, though eaten very generally in earlier times, it went out of use as food as the result of an edict of Pope Gregory III, dating from the eighth century. This prohibition, it would seem, was more effective in Continental Europe than in England. At any rate, a book by W. Boyd Dawkins, "Cave Hunting: Researches on the Evidence of Caves Respecting the Earlier Inhabitants of Europe" (London: Macmillan Co., 1874), gives interesting information about the animals, including the horse, used for food in Roman Britain, and about the abandonment of horse flesh as food because it was again forbidden by the Church, but under different circumstances.

The bones of the Celtic short-horn (Bos longifrons) were found to be very abundant in the Romano-Celtic or Brit-Welsh stratum of the Victoria Cave, Settle, Yorkshire; also those of a variety of the ox indistinguishable from the small dark mountain cattle of Wales and Scotland, which were the chief food of the inhabitants.

> A variety of the goat with simple recurved horns, which is commonly met with in the Yorkshire tumuli . . . , and in the deposits round Roman villas in Great Britain, furnished the mutton; while the pork was supplied by a domestic breed of pigs with small canines; and since the bones of the last animal belong, for the most part, to young individuals, it is clear that the young porker was preferred to the older animal. The bill of fare was occasionally varied by the use of horse-flesh, which formed a common article of food in this country down to the ninth century. To this list must be added the venison of the roedeer and stag, but the remains of these two animals were singularly rare. Two spurs of the domestic fowl, and a few bones of wild duck and grouse, complete the list of animals which can with certainty be affirmed to have been eaten by the dwellers in the cave. . . . There were also bones of the dog, which from their unbroken condition proved that the animal had not been used for food, as it certainly was used by the men who lived in the caves of Denbighshire, in the Neolithic age. The whole group of remains implies that the dwellers in the Victoria Cave lived upon their flocks and herds rather than by the chase. And since the domestic fowl was not known in Britain until about the time of the Roman invasion, the presence of its remains fixes the date of the occupation as not earlier than that time. On the other hand, since the small Celtic short-horn (Bos longifrons) was the only domestic ox in use known in Roman Britain, and since it disappeared from those portions of the country which were conquered by the English, along with its Celtic possessors, the date is fixed in the other direction as being not much later than the Northumbrian conquest of that portion of Yorkshire.

Elsewhere in the book the author quoted tells that the

> broken bones of the horse [in these caves] . . . leave no room to doubt that horse-flesh was a common article of food at that time. It was so, indeed, throughout Roman Britain, and after the English invasion was used as late as the Council of Celchyth, in the year 787. It was forbidden by the Church because it was eaten by the Scandinavian peoples in honor of Odin. In Norway, Hacon, the foster-son of Aethelstan, was compelled to eat it by the bonders, in 956, and the revolt of the bonders, which ended in the bloody battle of Stikkelstadt, in which Olaf met his death, in 1030, was caused by his cruelties to the eaters of horse-flesh. As Christianity prevailed over the worship of Thor and Odin, it was banished from the table. The present prejudice against its use is a remarkable instance of the change in taste which has been brought about by an ecclesiastical rule aimed against a long-forgotten faith. The rule was not, however, always obeyed, for the Monks of St. Gall, in the eleventh century, not only ate horse-flesh but returned thanks for it in a metrical grace written by Ekkehard the Younger (died 1036): "Sit feralis equi caro dulcis sub cruce Christi."

C. F. LANGWORTHY

WASHINGTON, D. C.

EFFECT OF PLANT EXTRACTS ON BLOOD SUGAR

OUR studies in connection with insulin led us to the conception that carbohydrate metabolism is performed by an oxidizing ferment mechanism. This theoretical conception induced us to test vegetable material, known to contain oxidases and peroxidases, for oxidizing substances having an insulin-like action. In December, 1922, we injected 5 cc. of juice from a raw potato intravenously into a 1,500 gram rabbit and noted a fall of blood sugar in one hour from 0.17 to 0.13 per cent. Since then we found that sterile pieces of raw potato, and juice expressed from these, introduced into a glucose solution, after incubation for 24

hours at 37 C, caused this to lose from 26 to 36 mg. of glucose per 100 cc.

These results were published in *Journal* of the American Medical Association on June 2, 1923, together with results indicating a diminished glycolytic power of blood from diabetics.

Winter and Smith published a note in the *Journal of Physiology*, 57:40 (Nos. 3 and 4), 1922, which appeared in this country in April, 1923, and in *Nature* of March 10, 1923, that they had obtained an insulin-like substance from yeast.

Collip, in *Nature* of April 28, 1923, states that he, working independently, found an insulin-like substance in various vegetables, in yeast and in clams. Collip's studies on insulin are of inestimable value and made it possible to obtain insulin from animal pancreas in quantities for practical use. He expected to find an insulin-like substance wherever glycogen occurred in nature, and for this reason looked for it in vegetable extracts. Our belief that oxidizing ferments cause glucose metabolism led us to examine vegetables for these ferments and for substances with an insulin-like action. It seems that Collip's theory and ours dovetail. A storehouse of food (glycogen, starch, etc.) and a ferment for the metabolism of this food are necessary wherever growth occurs in vegetables.

Our studies have led us to the tentative suggestion that insulin, which is apparently not itself an oxidase or peroxidase, indirectly stimulates or activates oxidizing ferments in the tissue cells to action upon glucose, whereas vegetable extracts contain active oxidizing ferments and act directly when injected into animals.

It would seem that the work of Winter and Smith, of Collip and of ourselves was being carried on simultaneously and independently. Collip, very properly, suggests that "these authors (Winter and Smith) would, therefore, share coincident priority with me in this particular." We think that we should be included in this share of priority.

WILLIAM THALHIMER
MARGARET C. PERRY
LABORATORIES OF COLUMBIA HOSPITAL,
MILWAUKEE, WIS.

A QUESTION OF RHETORIC

WHY do scientists like to write sentences like the following, which is quoted from the speech of a distinguished man as reported in SCIENCE, "Among the environmental factors which influence the structure and functions of the living organism, nutrition is of primary importance"? The sentence is absolutely correct, and doubtless conveyed the meaning intended to the audience of scientists. But we can sum up the substance of it in three words, "food is important." When so expressed it seems hardly worth saying. Possibly this does not express the meaning quite as accurately as the sentence used, but any doubts that might arise would be fully cleared up in the rest of the speech.

To be sure, more is implied in the sentence used than by the three words, "food is important." There is the suggestion of influencing structural changes by such means, as well as the elimination of any discussion of the effects of heredity, but it is doubtful if many of the scientists in the audience received the full value of such suggestions.

The sentence may have been all right for the audience, but the trouble is that when a person gets used to such methods of expression it is difficult to change when talking to ordinary people. A single unusual word is readily absorbed without breaking the thought. It very often adds to the force of the expression. By unusual word I am not now referring to one that is so unusual that it is not understood, but to one that is not the ordinary expression of the listener. Each such word causes a slight delay in grasping the thought. In the sentence quoted we find seven words which might not convey the thought immediately, and which would therefore be classed as unusual by this definition. Take, for example, the word "primary." The meaning is clear, but how many people would use it as used in ordinary conversation? The only use that most people make of the word "primary" is in connection with the schools.

With seven such words in so short a sentence, a certain amount of mental alertness is necessary to keep up with the speaker, or of concentration to read it. And when the thought reaches home, it is such a commonplace thought that it does not provide any stimulus for concentration on the next sentence.

But why not omit the sentence entirely? Why is it necessary to claim "primary importance" for the subject of nutrition? Would any anatomist deny it?

I do not want to criticize this speaker in particular, but am only pointing out one reason why scientists are not more often asked to explain their observations in publications that pay well. Professor Dry-as-dust is not as often the one whose learning is over the heads of his audience as the one who makes commonplace statements in language that requires an effort to understand it.

A. W. FORBES
WORCESTER, MASSACHUSETTS

QUOTATIONS

MEMORIES OF SIXTY YEARS

THAT a man who became a university graduate in 1859 has published in this year 1923 a volume of vig-

orous and interesting papers and addresses is a fact to encourage other octogenarians not to let their faculties rust. Dr. W. W. Keen, who is in London now to attend the meeting of the International Surgical Society, took part in what he calls the "horrible surgery" of the American Civil War, and has lived to be able to contrast it with that of the world war of 1914–1918. He himself was a pioneer of antiseptic surgery in America, and the longest article in the book is appropriately entitled "Before and after Lister." In other papers he denounces antivivisection, and advocates abstention from alcohol. But the book is not confined to professional subjects. In an address delivered in 1913 in connection with the hundredth anniversary of peace between Great Britain and America, Dr. Keen tells how, a few days before he spoke, he had been one of the signatories to an address beautifully engrossed on vellum, to be presented to the German Emperor, congratulating him on the fact that on June 15 of that year he would complete a twenty-five years' "reign of unbroken peace." Alas! in the following year the Emperor plunged into the great war, and Dr. Keen italicizes his conclusion that the world's hope lies in the amity, cooperation and solidarity of all the English-speaking peoples.

Medical ceremonials seem to have an attraction for Dr. Keen, and he gives pleasantly readable accounts of some graduation and other celebrations in which he has taken part—at Edinburgh, St. Andrews and Upsala. He also tells the story of the early years of Brown University of which he is a graduate. Though the author is now eighty-six years old, his outlook is rather that of a young man, and he concludes his book with a "message of hope" to the sufferers from malignant disease, if only they will seek advice and treatment early. Some of his cases were enjoying life fifteen and twenty years after operation, and he holds that there is a great field for X-rays and radium. Long may he himself continue to write reminiscently for the edification of the generation which is still in the fighting line of medical and surgical duty.—*The British Medical Journal.*

SCIENTIFIC BOOKS

The Preparation and Significance of Free-air Pressure Maps for the Central and Eastern United States. By C. LEROY MEISINGER, Monthly Weather Review Supplement 21, Washington, 1922, 4to, 77 pp., incl. tables, 31 diagr. and 22 charts.

THIS monograph is a milestone in the progress of American barometry. The last milestone was Frank H. Bigelow's "Report on the barometry of the United States, Canada and the West Indies" (Report of the chief of the Weather Bureau, 1900–1901, vol. II). The foundation of the daily weather map for forecasting purposes has always been the distribution of pressure at sea-level. Sea-level was the natural choice, because the forecasting began as storm warnings for navigators of the ocean. With the spread of the network of meteorological stations over the United States to elevations greater than 1,000 feet, the addition of fictitious air columns of great height in order to get "sea-level pressure" was recognized as a serious source of error. Bigelow very ingeniously patched over this difficulty, in part, but a satisfactory result was not attainable for the elevated western half of the country. Bigelow made an attempt at reducing pressures to levels 3,000 and 10,000 above sea-level, but his temperature argument, based on average temperature gradients of all weather, was too great a source of error. He had done enough, however, to make meteorologists hope for results helpful in forecasting, if accurate maps for levels in the free air could be made. Our weather occurs in the air, not at sea-level underground.

The long-needed revival of free-air pressure maps came as a result of the demands of aerial navigation during the war. Ocean navigation required forecasts from maps of sea-level conditions: now aerial navigation needs forecasts from maps of flying-level conditions. The widely separated observations by means of kites were wholly inadequate for the construction of synoptic free-air pressure maps. But the information gained as to temperatures at different heights provided the data necessary for the construction of reduction tables which could be used at other stations throughout the central and eastern United States. Dr. Meisinger found that for any month the vertical gradient in temperature up to 2 km. over any kite station was practically the same on every occasion with the same wind direction at the ground. He found also that the transitions between kite stations were so smooth that interpolations gave values sufficiently approximate for use over stations where free-air temperatures had not been observed. Thus, the construction of free-air pressure maps for levels such as 1 and 2 km. above sea-level was possible, merely from surface temperatures and wind directions, when based on average temperature gradients interpolated from the kite stations.

The laborious steps by which this possibility was developed into a practicability were, briefly, as follows: First, Dr. Meisinger determined for each kite station the vertical gradient in temperature to 1 km. and to 2 km. above sea-level, with each of the eight wind directions at the ground, in each of the twelve months. These he expressed in terms of the difference between the surface temperature and the mean temperature of the air column to each height. Second, these differences were mapped for each level for each wind direction for each month, lines of equal

difference being carefully interpolated between the kite stations. Third, about thirty Weather Bureau stations were chosen and the values for each determined from the maps, due consideration being given to the altitude of the station as compared with those of the kite stations. Given the surface temperature and wind direction at any station, an approximate mean temperature of the air column could now be obtained, which on substitution in the hypsometric formula would give the pressure at the required level.

Now Dr. Meisinger tested the accuracy of his results by constructing free-air pressure maps from the surface observations at the selected stations and comparing these with observations made at kite and pilot-balloon stations. In spite of errors to be expected from departures of actual from average gradients, owing to (1) the length of time the wind had been blowing from the observed direction, (2) the strength of this wind, (3) the prevalence of unseasonable weather, *e.g.*, March weather in April, (4) the presence of an unusual condition aloft, (5) errors of interpolation and (6) local influences on surface temperature and wind direction, 72 per cent. of the computed barometric values were within 0.05 inch of the observed values, and maps based on computed values were in most cases practically identical with those based on free-air observations made at the time.

From December 1, 1922, to February 28, 1923, 29 stations, each supplied with different barometric reduction tables, made daily postcard reports of computed pressures at 1 and 2 km. above sea-level. Dr. Meisinger checked and mapped the data as they arrived. The forecasters of the central office followed the new maps with interest, and have been considering whether they could be used in daily forecasting sufficiently to justify having the values made a part of the regular morning telegraphic message.

Aeronautical meteorologists and aviators, however, have long since made up their minds, and are asking for upper-air maps as a daily background for the more or less scattered and intermittent indications of winds at flying levels given by pilot balloons and by clouds. At the April 16, 1923, meeting of the American Meteorological Society the troubles of two aviators on the preceding day were cited. In two airplanes they attempted to fly from Moundsville, West Virginia, to Washington, D. C., along the Model Airway. In doing so, however, both had to fly through clouds in winds of unknown speed and direction. One soon descended on a field from which he could not rise. The other, after some very trying hours in the cloud, landed in the vicinity of Quantico, Virginia. A map of winds aloft, computed from maps of pressures at the 1 and 2 km. levels, would probably have been sufficient in the one case to prevent the mishap, and in the other to reduce the anxiety and prevent going beyond the destination. Pilot balloons are useful wind indicators in clear weather, and clouds in partly cloudy to cloudy weather, but computations serve in all weather. Daily telegraphic maps of computed pressures and winds checked by simultaneous pilot balloon and cloud observations are within reach and can provide the entire eastern half of the United States with fairly reliable indications of winds at flying levels in even the thickest weather.

As our forecasters now forecast the distribution of surface pressure, winds and temperature, so also they can forecast the winds at flying levels 12, 24 or 36 hours in advance. The new barometric reduction tables can be applied to these forecast values to predict the distribution of pressure at the 1 and 2 km. levels, and hence of wind direction and velocity over any part of the central and eastern United States.

The long standing barometric reduction problem of the elevated western states may be attacked along the same lines as in the east, as soon as kite stations are established and records obtained. The computation of pressures at heights greater than 2 km. should also prove practicable by the methods evolved by Dr. Meisinger.

CHARLES F. BROOKS
CLARK UNIVERSITY

Magnetic Declination in the United States for January 1, 1920.[1] By D. L. HAZARD.

THE title of this publication only partly suggests the valuable material it contains. The magnetic declination in the United States, northern Mexico and adjacent waters, referred to January 1, 1920, as well as the present rate of its annual change, is graphically shown on an isogonic chart, scale 1:7,000,000. The 30 pages of text, however, contain matters of equal interest.

The early land surveys in the United States were made by compass, and boundaries in many old deeds are referred to compass bearings. In order to retrace these the surveyor must not only know the present variation, or declination, of the compass, but must be able to determine what it was at the time of the original survey. This paper contains a table of the values of the declination at one or more places in each state, 108 such places in all, for which the declination is given for each decade since the earliest available determinations, going back in some cases to the year 1750. It is not to be assumed that actual determinations were made at the selected points in each of the years named, but that the tables are made by process

[1] Washington, D. C., U. S. Dept. Comm., Coast and Geod. Surv., *Spec. Pub.* No. 90, 1922 (30 with chart). 23 cm.

of grouping so that a mean result refers to a mean position. This is now possible by reason of the present state of knowledge of the general distribution of declination, and of the general nature of the movement of the secular-variation curves across the country.

The surveyor need not in general concern himself with questions of diurnal variation, but in careful work it should be considered. A table of the mean departure from the mean of day at different seasons at the five magnetic observatories operated by the Coast and Geodetic Survey for each hour of the day is given in convenient form.

A considerable space has been given to detailed methods of finding the true meridian by observations of the sun and of Polaris, so that a surveyor having quite simple equipment may determine for himself the declination at any desired station. Tables are provided so that any person, with nothing more than a plumb-line and simple carpenter's tools, may easily lay off a true meridian anywhere within the United States by observations on Polaris. The tables are extended to the year 1932. More precise methods are explained for those equipped with a surveyor's transit or its equivalent.

While intended primarily for the use of the land surveyor, the book will be found to contain much interest for students and teachers of physics and surveying, supplementing helpfully the rather inadequate chapters on terrestrial magnetism in most general text-books on these subjects.

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SPECIAL ARTICLES

X-RAYS AND CROSSINGOVER

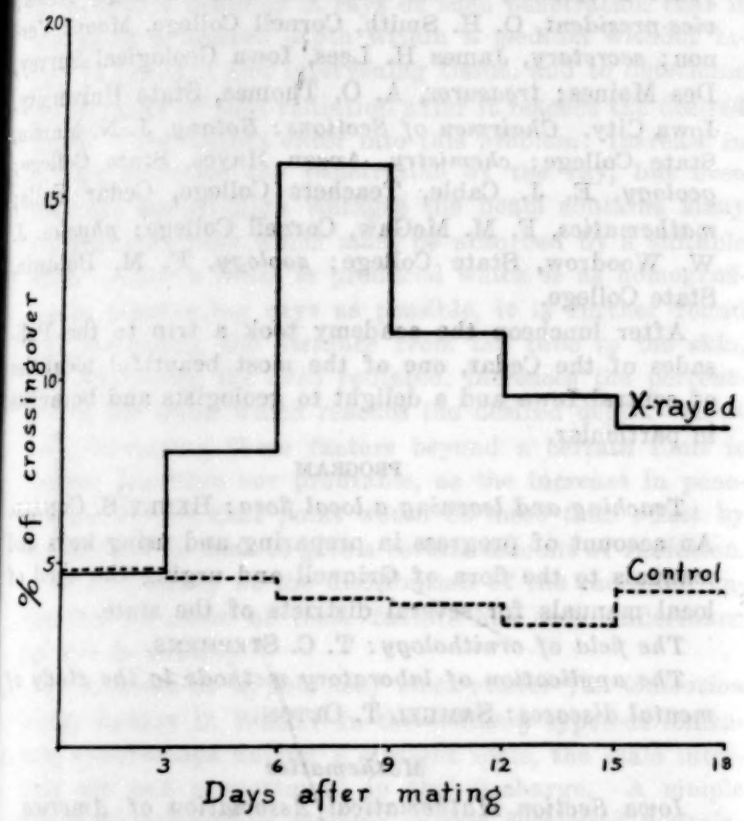
WHEN two or more Mendelian characters which enter a cross from one parent are found to be associated in a greater number of the offspring than could be the case if they segregated independently, the characters are said to be linked. In such a cross the offspring in which the characters are not associated are said to owe their origin to crossingover, the term referring to a process believed to occur in the chromosomes. The percentage of the total offspring in which crossingover occurs is the crossover value for the two characters in question. A small crossover value means a close linkage of the characters and a large crossover value a loose linkage. When a normal, wild-type fruit-fly (Drosophila melanogaster), to take an actual example, is mated with a black-bodied, purple-eyed and curved-winged fly the heterozygous offspring obtain the factors for the three mutant characters from one parent. If now the daughters of such a cross are back-crossed to black purple curved males, a majority of their offspring will be either wild type or black purple curved, showing that these characters are linked (in this case in the second chromosome). There will be also a number of offspring in which the characters are not associated, *e.g.*, normal bodied, purple eyed and curved winged and black bodied, normal eyed and normal winged (crossingover between black and purple), normal bodied, normal eyed and curved winged and black bodied, purple eyed and normal winged (crossingover between purple and curved) and normal bodied, purple eyed and normal winged and black bodied, normal eyed and curved winged (double crossingover). The percentages of crossingover between the characters mentioned have been accurately determined independently by Bridges, Muller and Plough and a summary of their results is given by Bridges and Morgan.[1] They give as the weighted averages of all previous determinations for crossingover between black and purple, 6.2 per cent., the determination having involved somewhat over 50,000 flies, and for crossingover between purple and curved, 19.9 per cent., this determination having involved somewhat over 60,000 flies. It should be added that the determinations by the different investigators are in agreement.

The investigation to be described in the present paper included two experiments. In the first of these twenty sisters from the mating of a wild type female with a black purple curved male were used. Eleven were kept as controls and nine were X-rayed for 3 minutes and 15 seconds at a distance of 23.5 cm from the tungsten target, the Coolidge tube being operated at 50,000 volts and .05 amperes. Previous experiments had shown that the temperature in the X-ray box in which the flies were exposed did not vary from that of the room by more than 1° C. On the day after the X-raying all of the twenty females were mated to black purple curved males and placed in individual culture bottles. The pairs, control and X-rayed, were changed to new bottles every three days until the eighteenth day when they were killed. The offspring coming out in the bottles were counted daily until the seventeenth day after mating. The second experiment was performed in the same way with the following exceptions: the control contained eleven pairs and there were twenty-seven pairs in which the females were X-rayed. The X-ray treatment was the same except that the time was shortened to 3 minutes. The females were mated immediately after being X-rayed and were transferred to new bottles every three days until the twelfth day when they were killed. The flies coming out in the culture bot-

[1] Publ. No. 278 Carnegie Institute of Washington, p. 123.

tles were counted every three or four days until the seventeenth day after mating. The bottles of both experiments were kept in an incubator set at 22° C. and during the whole time the temperature did not go below 20° C. or above 24° C.

Space will not allow the publication here of tables giving the numbers of crossovers and the per cents. and probable errors calculated from them. In figure 1 is a graph of the weighted values of the percentages of



crossingover between black and purple for three-day intervals (each set of bottles) for both of the experiments. The graphs of the separate experiments are similar to the one reproduced with the exception that in the case of the first experiment in which the females were given the larger dose of X-rays, the total number of offspring produced in the first bottles was too small to give a significant crossover value and that in the case of the second experiment the graph does not extend beyond the twelfth day. The control (dotted line) varied from 4.78 per cent. to 3.25 per cent., showing a slight decrease with age until the fifteenth day. This decrease in the crossover value with age has already been reported by Bridges[2] and Plough.[3] The effect of the X-rays on the crossover value (continuous line) becomes apparent in the counts of the offspring of the X-rayed females in the second bottles (the 4th to the 7th day after X-raying in the case of the first experiment and the 3rd to the 6th day in the case of the second experiment). The effect of the X-rays is greatest in the third bottles (6th to 9th day after mating). The fourth, fifth and sixth bottles (9th to 18th day) show a gradual recovery toward the crossover value of the control. The difference between the crossover value in the cultures of the X-rayed and control females divided by the probable error of the difference is for each of the six bottles 0.16, 6.11, 29.14, 20.78, 5.78 and 3.07, respectively.

The data obtained show that X-rays have a similar effect on crossingover between purple and curved although the increase in crossingover is not so great and recovery to the normal crossover value is apparently more rapid. The values of the coincidence of crossingover between black to purple and purple to curved for the cultures of the X-rayed and control females can not be determined with a sufficiently small probable error to admit of an accurate comparison. It may be stated, however, that the values found for coincidence in the cultures of the X-rayed females show no great increase or decrease compared with those of the control cultures.

A careful tabulation and comparison of the percentages of the complementary crossover classes, *e.g.*, normal bodied, purple eyed and curved winged compared to black bodied, normal eyed and normal winged, has shown that the increase in the crossover value found in the cultures of the X-rayed females can not be explained as due to a difference in viability arising from the X-ray treatment of the unfertilized eggs. Such a comparison does not give an absolute proof that the viability of the characters is unaffected by the X-rays since the experiments do not give an opportunity to compare all possible combinations of the characters but it does show that there is not a sufficient difference between any of the classes of offspring of the X-rayed and control females to account for the increase in the crossover value found for the X-rayed females.

It is of great interest to compare the effect which the experiments described show X-rays to have on crossingover in the second chromosome with the effect which Plough[3] has found temperature to have on crossingover. Plough found, using the same characters, that submitting females to temperatures either considerably above or below the normal rearing temperature (22° C.) caused an increase in the crossover value. The X-ray experiments show that X-rays also cause an increase in the crossover value when the flies are kept at a temperature of 22° C. Whereas Plough found that the effect of temperature on crossingover became first apparent on the seventh to eighth day after the beginning of the heat treatment, the X-ray experiments show that the X-ray effect on crossingover becomes apparent on the fourth to seventh day (first experiment) or third to sixth day (second experiment). It is possible that this difference is due to an accelerated development of the eggs due to the

[2] *Journ. Exp. Zool.*, Vol. 19, No. 1.
[3] *Journ. Exp. Zool.*, Vol. 24, No. 2.

X-rays although no other evidence of acceleration is evident in the experiments, *e.g.*, earlier hatching out of offspring of X-rayed flies. A more striking difference is that while the effect of temperature lasts for a time corresponding to the period of time treated and then disappears abruptly the effect of an X-ray treatment which lasted only 3 minutes and 15 seconds starts on the third to sixth day, reaches a maximum on the sixth to ninth day, and then gradually falls off, the effect being still evident after fifteen days.

The effect of X-rays on crossingover in the second chromosomes may be compared with the effect of X-rays on crossingover in the first or sex chromosome already recorded by one of us.[4] Here it was found that X-rays decrease the crossover value for eosin eyed and miniature winged, the effect increasing with the dose. After a dose approximately the same as that given in the first of the experiments on the second chromosome the crossover value for eosin and miniature was decreased from approximately 25 per cent. to less than 10 per cent. and the effect continued from the sixth to the twelfth day after the treatment. We see, then, that X-rays produce opposite effects on crossingover in the first and second chromosomes of Drosophila. This and the duration of the effect suggest that X-rays act on the individual chromosomes affecting them in such a way that crossingover, when it occurs, is modified.

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THE IOWA ACADEMY OF SCIENCE

THE academy met at Cornell College, at Mount Vernon, on April 27 and 28. The opening session was held on Friday afternoon, the 27th, and included, besides the transaction of preliminary business, addresses by three invited speakers. The sections of the academy met at 3 P. M. for reading of papers and at 6 o'clock held their group dinners. President Wylie gave his address on "Experiences in Fiji and New Zealand" at the evening session, after which the faculty of the college held an informal reception for the visitors.

On Saturday morning the sections completed their programs, after which the academy convened for the final business session. The academy took some forward steps in adopting resolutions looking towards an extensive biological survey of the state, in establishing a committee on coordination of scientific research, and in endorsing the plan to establish a national museum and aquarium of fishes in honor of Spencer Fullerton Baird. In adopting the report of the committee on the secretary's report the academy provided for the appointment of a permanent committee on publication which should report to the academy a set of rules and suggestions for preparation and publication of papers. The academy transferred eighteen Associates to the class of Fellows and elected nine new Fellows and sixty Associates. It voted to meet with the State College at Ames in 1924, when Dr. L. H. Pammel, who has been a Fellow of the Academy since 1889, will have completed thirty-five years of service with the State College.

The following were elected officers for the ensuing year: *President*, L. H. Pammel, State College, Ames; *vice-president*, O. H. Smith, Cornell College, Mount Vernon; *secretary*, James H. Lees, Iowa Geological Survey, Des Moines; *treasurer*, A. O. Thomas, State University, Iowa City. *Chairmen of Sections: Botany*, J. N. Martin, State College; *chemistry*, Anson Hayes, State College; *geology*, E. J. Cable, Teachers College, Cedar Falls; *mathematics*, F. M. McGaw, Cornell College; *physics*, J. W. Woodrow, State College; *zoology*, F. M. Baldwin, State College.

After luncheon the academy took a trip to the Palisades of the Cedar, one of the most beautiful localities of central Iowa and a delight to geologists and botanists in particular.

PROGRAM

Teaching and learning a local flora: HENRY S. CONARD. An account of progress in preparing and using keys and manuals to the flora of Grinnell and urging the need of local manuals for several districts of the state.

The field of ornithology: T. C. STEPHENS.

The application of laboratory methods to the study of mental diseases: SAMUEL T. ORTON.

Mathematics

Iowa Section Mathematical Association of America

Abstracts of these papers will be found in the journal of the American Mathematical Association.

On the correction of a common error in the calculation of the mean deviation from a given frequency distribution: H. L. RIETZ.

On the geodesic in four space: CORNELIUS GOUWENS.

A general expression for the schediastic function for the generalized double frequency distribution: E. R. SMITH.

Leibnitz's contribution to the history of complex numbers: R. B. MCCLENON.

Some curves met with in the conformal representation of integral transcendental functions: R. B. MCCLENON.

The definite integral in a first course in calculus: J. V. MCKELVEY.

Certain preliminaries in the calculus: C. W. EMMONS.

The Cochleoïde: ROSCOE WOODS.

On the theory of wave filters with an application to the theory of acoustic wave filters: E. W. CHITTENDEN.

Some functional equations suggested by the mean value theorem: W. H. WILSON.

The differentiation of the trigonometric functions: W. H. WILSON.

What is mathematics? J. S. TURNER.

An application of finite differences: JOHN F. REILLY.

The cycloid and its companion: ELMER E. MOOTS.

[4] *Proc. Soc. Exp. Biol. and Medicine*, Vol. 20, p. 335.

Physics

A new method for stereoscopic projection: JAY W. WOODROW.

Diffusion of alkali salt vapors in the Bunsen flame: GEORGE E. DAVIS.

The progress of research in the Coe College radiological laboratory: SCOTT W. SMITH, JR. The aim of the laboratory has been to investigate such problems in the physics of X-rays as are of vital importance in the medical science. The important problem in deep therapy is to produce a beam of X-rays of such penetration that it will reach a desired depth within a medium without injury to the skin and intervening tissue, and to determine the intensity of that radiation after it reaches the desired depth. Five factors enter into this problem: Increase in *voltage* increases the penetration of the ray, but even with the use of high voltages the beam contains many harmful soft rays which must be absorbed by a suitable *filter*. After a beam is produced which is as homogeneous in penetrating rays as possible, it is further found that increasing the *distance* from the tube to the skin, also increasing the *area* radiated, increases the percentage of the beam which reaches the desired depth. However, increasing these factors beyond a certain limit is neither desirable nor profitable, as the increase in penetration beyond that point would be more than offset by the increase in *time* to give a certain amount of radiation. A detailed study of the distribution of the radiation under the variation of these factors has been undertaken by this laboratory.

Calibration of a gold leaf electrometer for ionization work: LEROY D. WELD. In the ordinary types of ionization electroscope having a straight scale, the scale intervals are not proportional to the discharge. A simple quadratic calibration formula is here developed, containing only one constant, whereby the readings can be transformed into those of a scale of equal discharge intervals, and the method of obtaining the constant is explained. Rates of fall on the actual and corrected scales are also compared by means of a linear formula. The calibration is of particular importance in the case of shortlived radioactive products, with which the usual method of fall between fixed points can not be applied, because there is not time to recharge the electroscope. Numerical examples are given illustrating the theory.

Acoustic wave filters in solid media: V. C. HALL.

An extension of acoustic wave filter theory: G. W. STEWART.

New vibrations within a conical horn: VICTOR A. HOERSCH.

The "K" and "L" X-ray spectra of tungsten: C. B. CROFUTT. This paper is a partial report on the complete investigation of the X-ray spectra of tungsten, both emission and absorption. It deals only with the emission and absorption spectra of the "K" and "L" regions. The "M" region is being investigated by Mr. R. V. Zumstein. The X-ray spectra of tungsten have been the most extensively investigated of any element. However, the work has been done at different times by experimenters using different apparatus and methods. For this reason it seemed advisable to make a complete investigation, using as near as possible the same apparatus and conditions throughout. Previous work has been done either on the emission spectra or the absorption spectra and no attempt has been made to get both at the same time under the same conditions. In the present work both have been obtained on the same photographic plate at the same exposure. This furnishes a very accurate method of measuring relative wave lengths. The apparatus used in the work consisted of a high voltage transformer, Coolidge tube and X-ray spectrometer. A few improvements in the method of rotation of the crystal made it possible to greatly prolong the time of exposure. When this work was begun there were twenty-two lines known in the "L" series of tungsten. Out of these twenty-two lines one had been found only by Siegbahn and Duane, three by Dershem and Overn and one by Overn. In the present work all of the above lines except the one found by Siegbahn and Duane have been obtained. In addition, three new lines have been found and two others have been resolved into two components. The most important result of the work on the "L" series is the slight shift obtained in the result given by Duane on the absorption wave lengths, which have been considered as the most accurate. This shift is sufficient to change the relative positions of two of the absorption lines with respect to that of the emission lines. Since both the emission and absorption spectra are obtained on the same plate at the same exposure there can be no question as to the relative positions of the lines. The results to date on the "K" series show that the line is made up of two components. The "K" absorption band has been obtained in the third order on the same plate with the emission lines.

Scattering of homogeneous X-rays by liquid benzene, mesitylene and octane, and by diamond splints: C. W. HEWLETT. I. Scattering curves for liquid benzene, mesitylene and octane. The X-radiation from a molybdenum X-ray tube was filtered through a ZrO^1 screen which reduced the Mo Kα (.710Å) line very little but cut the other lines and the general radiation to a very small amount. The intensity of the radiation scattered by the liquids contained in a small capsule placed at the center of a spectrometer was measured by the ionization method for angles 8° to 16° on each side of the principal maximum which these liquids show. The principal maximum for octane due to the Kα line is 8.12Å, for benzene 8.45Å, for mesitylene 6.45Å and 10.08Å. The spacing of the planes of atoms responsible for these maxima in octane is 5.0Å, in benzene is 4.8Å and in mesitylene is 6.3Å and 4.1 Angstroms. For each liquid a hump is noticed at an angle less than the angle of the principal maximum, but this is shown to be due to the general radiation which gets through the filter. II. The temperature effect of the scattering of X-rays by diamond splints. The intensity of X-radiation scattered by diamond splints at room temperature and at 300°C. was measured for the angles 2° to 165°. There is a shift of the maxima due to the expansion of the crystal. The results, however, would indicate that the expansion is not